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Population dynamics and eggsac parasitism of *Erigone atra* (Blackwall) in winter wheat

Axel DINTER
Institute for Plant Diseases and Plant Protection
University of Hannover, Herrenhäuser Str. 2, D-30419 Hannover, Germany.
E-mail: Dinter@Mbox.JPP.Uni-Hannover.De

Population dynamics and eggsac parasitism of *Erigone atra* (Blackwall) in winter wheat. - The population dynamics of spiders were monitored in winter wheat fields in northern Germany from 1989 until 1991 using an intensive D-vac sampling method (actual densities) and pitfall trapping (activity densities). *Erigone atra* was the dominant species in all three years. Numbers caught in pitfall traps reached peaks in April/May and June/July. Actual densities of *E. atra* adults increased in June/July (> 25 individuals/m^2) but declined before harvest. Aerial activity of spiders, as measured by water traps, was low in spring and summer 1989. Visual observations gave evidence that high proportions of *E. atra* adults leave winter wheat by ballooning before harvest. D-vac sampling also gave an estimation of the number of *Erigone* eggsacs present in the field in 1990 and 1991. Eggsacs sampled by D-vac were kept in the laboratory for a month until the emergence of spiderlings or parasitoids. Nine hymenopteran species were reared from *Erigone* eggsacs. Most of the *E. atra* females collected in winter wheat in summer 1990 and kept in petri-dishes with moist paper in the field for a period of 10 days, produced eggsacs. These investigations indicate that descendants of *E. atra* adults which overwinter in wheat fields or immigrate in spring become adult in June/July and only a few weeks later a great proportion of these adults leave winter wheat by ballooning.

Key-words: Spiders - Linyphiidae - *Erigone atra* - D-vac sampling - pitfall trapping - actual densities - population dynamics - ballooning - eggsac parasitoids.

INTRODUCTION

Large parts of the European landscape are used for agriculture. Cereals, and especially winter wheat, are in most countries the main crops where spiders are a common group of polyphagous predators (HEYDEMANN 1983). Numerous pests (aphids, flies, midges) are prey items of spiders in crop fields (ALDERWEIRELDT

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1994a). The importance of spiders as antagonists of cereal aphids in winter wheat fields was documented by SUNDERLAND *et al.* (1986) and NYFFELER & BENZ (1988). Despite their purported role in agroecosystems, there are only a few investigations on the population dynamics of spiders that continuously measured population densities of single spider species in agricultural crops. DE KEER & MAELFAIT (1988*a*) studied the life cycle of *Erigone atra* (Blackwall) in a heavily grazed pasture in Belgium. The population dynamics of *Erigone arctica* (White) was investigated by VAN WINGERDEN (1977) on the coastal plain of a Dutch Frisian island. TOPPING & SUNDERLAND (1994) presented a spatial population dynamics model for *Lepthyphantes tenuis* (Blackwall) in English farmland based on knowledge concerning reproduction, population growth and migration. Also, there is only an incomplete knowledge of eggsac parasitism of European spider species; this is briefly reviewed by FITTON *et al.* (1987).

This contribution summarizes data of a three year study on the population dynamics of *E. atra* in conventional winter wheat farming; side-effects of spraying insecticides on this species will not be considered here and are published elsewere (DINTER & POEHLING 1992*a*, *b*, 1995, DINTER 1995*a*).

MATERIALS AND METHODS

From April 1989 to August 1991 the investigations were carried out in a 20 ha (1989/90) and a 10 ha (1990/1991) field of winter wheat near Göttingen in Lower Saxony, Germany. Spider density dynamics were studied on three plots (48 m x 100 m) in 1989 and on two plots (72 m x 100 m resp. 84 m x 100 m) in 1990 and 1991. Parts of the fields containing these plots were not sprayed with insecticides for aphid control. Mobile epigeic spiders were monitored at weekly intervals by means of 10 pitfall traps per plot from April to August. At other times 10 (1989/90) resp. 20 (1990/91) pitfall traps were run at intervals of up to four weeks. Plastic cups with a diameter of 8.3 cm, and containing ethylene glycol as preservative, were used. Actual spider densities were estimated by an intensive D-vac sampling technique described by DINTER & POEHLING (1990), which is an appropriate method to give an exact estimation of the real densities of *E. atra* and other spider species (DINTER 1995*b*). For this method, the diameter of the nozzle of a standard D-vac suction machine (DIETRICK 1961) was reduced from 33 cm to 20 cm to guarantee a high suction effect. Sampling was done within 0.25 m^2 areas which were enclosed by metal cylinders. The plants inside this cylinder were shaken and cut off 10 cm above ground level as soon as the wheat was higher than 15 cm. Finally the areas were sampled by D-vac uniformly for a total of 3 min (after 1 min the collected material was removed from the gauze bag to guarantee continous high suction efficiency during the following 2 min). The two pooled samples were kept cool until the spiders and *Erigone* eggsacs could be processed by hand in the laboratory. Until November 1989 eight D-vac samples (2 m^2) were taken per date, then twelve D-vac samples (3 m^2) were taken per date. *Erigone* eggsacs, which were also found in the D-vac samples, were kept individually in small glass vessels at 20 °C and 16h/8h daylength for about a month. Some of the hymenopteran parasitoids which emerged from *Erigone* eggsacs were kept in the laboratory (supplied with honey water and tap water) to measure their longevity. Furthermore, one- to four-day-old *E. atra* eggsacs laid in the laboratory were offered to some of these parasitoids over a period of 24h and then kept until spiderlings or adult Hymenoptera emerged from them.

Several times from April to June females of *E. atra* (n = 20) were collected in the field by D-vac and then individually kept in petri-dishes (ø 53 mm) on moist paper without food for a period of 10 days under ambient temperatures to count the number of eggsacs produced and to measure the duration until the emergence of spiderlings from these eggsacs.

From April to August 1989 ballooning activity of spiders was monitored at intervals of two to five days by nine water traps (46.0 cm x 28.5 cm, filled with water and 'Pricol' as detergent) located at the upper vegetation level in the wheat field.

RESULTS

The most abundant spider species occurring in the wheat fields studied belong to the Linyphiidae. From April to August the adult spider fauna was mainly dominated by *E. atra* (Table 1). The mean percentage of *E. atra* varied between 23.6 % and 48.6 % of all adult spiders in the D-vac samples while 40.9 % to 64.0 % of the individuals caught in pitfall traps belonged to this species.

E. atra occurred in the winter wheat fields or volunteers during the whole year at densities from 1 individual/m^2 (October 1990) to 27 individuals/m^2 (June 1990) (Fig. 1). From March to April (1990 and 1991) or early in May (1989) the density of *E. atra* gradually increased up to 5 - 10 individuals/m^2. During the following weeks, until mid-June (1989) or late in June (1990 and 1991), the abundance of *E. atra* remained constant (1989 and 1990) or decreased (1991). Thereafter, the numbers of adults increased rapidly to peaks up to 12 (1989), 27 (1990) or 15 (1991) individuals/m^2. In 1990 and 1991 the increase in *E. atra* density lasted for only a few days and then numbers declined to a few individuals/m^2 before harvest. In summer 1989 no such reduction could be observed and the density of *E. atra* was stable until harvest. From September 1989 to March 1990 resp., in winter 1990/91, constant numbers of *E. atra* adults were sampled by D-vac (~ 4 individual/m^2 in 1989/90 resp. ~ 1 individual/m^2 in 1990/91).

The pattern of pitfall trap catches of *E. atra* adults was roughly similar to that for D-vac sampling (Fig. 1). Whereas in the D-vac samples males were found less numerous than females, males dominated in the pitfall trap catches. In 1989, the pitfall trap catches more or less increased continously until harvest. In February 1990 (extremely mild temperatures) or March 1991 the numbers caught in pitfall traps increased and reached peaks in April/May of both years. Thereafter, numbers of *E. atra* found in pitfall traps declined until mid-June (1990) or early in July (1991). Within only a couple of days the maximum numbers of *E. atra* were caught during the end of June (1990) or early in July (1991). While in 1990 the pitfall trap catches decreased before harvest, in the other two years high numbers of *E. atra* were still

TABLE 1

Composition of dominant spider species (> 10 %, percentage of total catch of adult spiders) and total number of spiders (adults and juveniles) in intensive D-vac samples and pitfall trap catches in 7 winter wheat plots in 1989 (a,b,c), 1990 (a,b) and 1991 (a,b).

	Intensive D-vac						
	89a	**89b**	**89c**	**90a**	**90b**	**91a**	**91b**
total number of individuals	1073	841	784	4837	4023	1953	3104
Erigone atra (Blackwall)	28.0	35.1	38.0	48.6	44.4	23.6	38.6
Lepthyphantes tenuis (Blackwall)	24.4	26.8	26.9	20.4	22.7	28.6	26.7
Bathyphantes gracilis (Blackwall)	19.5	12.7	12.0	8.4	12.3	10.0	9.7
Oedothorax apicatus (Blackwall)	1.9	1.4	0.8	0.2	2.3	9.5	2.8
Erigone dentipalpis (Wider)	0.8	0.7	0.8	2.3	2.1	1.0	0.6
	Pitfall traps						
	89a	**89b**	**89c**	**90a**	**90b**	**91a**	**91b**
total number of individuals	1354	856	1220	2733	2633	2988	3151
Erigone atra (Blackwall)	53.2	55.7	53.6	64.0	57.9	40.9	58.8
Oedothorax apicatus (Blackwall)	17.4	22.5	19.5	7.2	11.5	37.8	22.9
Erigone dentipalpis (Wider)	9.2	6.6	5.3	10.0	10.6	1.8	3.8
Lepthyphantes tenuis (Blackwall)	2.2	3.1	4.6	2.8	4.3	3.3	3.9
Bathyphantes gracilis (Blackwall)	2.2	1.3	1.3	1.5	4.2	1.4	1.8

Sampling dates: Intensive D-vac: 89a (16.5., 31.5., 13.6., 15.6., 20.6., 29.6., 10.7., 20.7.), **89b** (5.5., 18.5. 6.6., 22.6., 26.6., 6.7., 17.7.), **89c** (9.5., 23.5., 10.6., 18.6., 24.6., 4.7., 13.7., 25.7.), **90a** (9.4., 2.5., 18.5., 30.5., 1.6., 5.6., 12.6., 27.6., 11.7., 26.7.), **90b** (26.4., 10.5., 18.6., 21.6., 24.6., 1.7., 4.7., 19.7., 1.8.), **91a** (13.5., 28.5., 12.6., 18.6., 22.6., 25.6., 4.7., 18.7., 30.7., 7.8.), **91b** (10.4., 21.5., 5.6., 2.7., 7.7., 10.7., 12.7., 16.7., 29.7., 5.8.). **Pitfall trap catches: 89a** (17.5., 31.5., 14.6., 17.6., 20.6., 5.7., 12.7., 26.7.), **89b** (10.5., 24.5., 7.6., 23.6., 26.6., 6.7., 19.7.), **89c** (10.5., 24.5., 14.6., 20.6., 26.6., 10.7., 17.7, 26.7.), **90a** (11.4., 2.5., 23.5., 31.5., 3.6., 6.6., 13.6., 27.6., 16.7., 30.7.), **90b** (2.5., 16.5., 19.6., 22.6., 25.6., 2.7., 9.7., 23.7., 6.8.), **91a** (15.5., 29.5., 12.6., 21.6., 24.6., 27.6., 4.7., 18.7., 1.8., 8.8.), **91b** (10.4., 22.5., 5.6., 4.7., 8.7., 11.7., 14.7., 21.7., 29.7., 5.8.).

found in the traps even up to a few days before harvest. During autumn and winter (October to January) only small numbers of *E. atra* adults were collected by pitfall trapping.

Numbers of ballooning juveniles (all species pooled) were always more numerous in the water traps than adults of any single spider species including *E. atra* (Fig. 2). Ballooning activity of *E. atra* adults remained low between the end of April and the end of June. Peak numbers of ballooning juveniles and *E. atra* adults were recorded in July. Additionally on 20th July mass ballooning activities of spiders, mainly linyphiids (adults, incl. males and females of *E. atra*, and juvenile linyphiids), climbing up the wheat tillers and leaving the wheat by ballooning were observed. Mass take-off of *E. atra* adults and several other spider species was also seen June on 26th and 29th in 1990 and on July 21st in 1991. Following these mass ballooning events, a substantial decrease of population densities of *E. atra* adults occured in 1990 and 1991 (see Fig. 1).

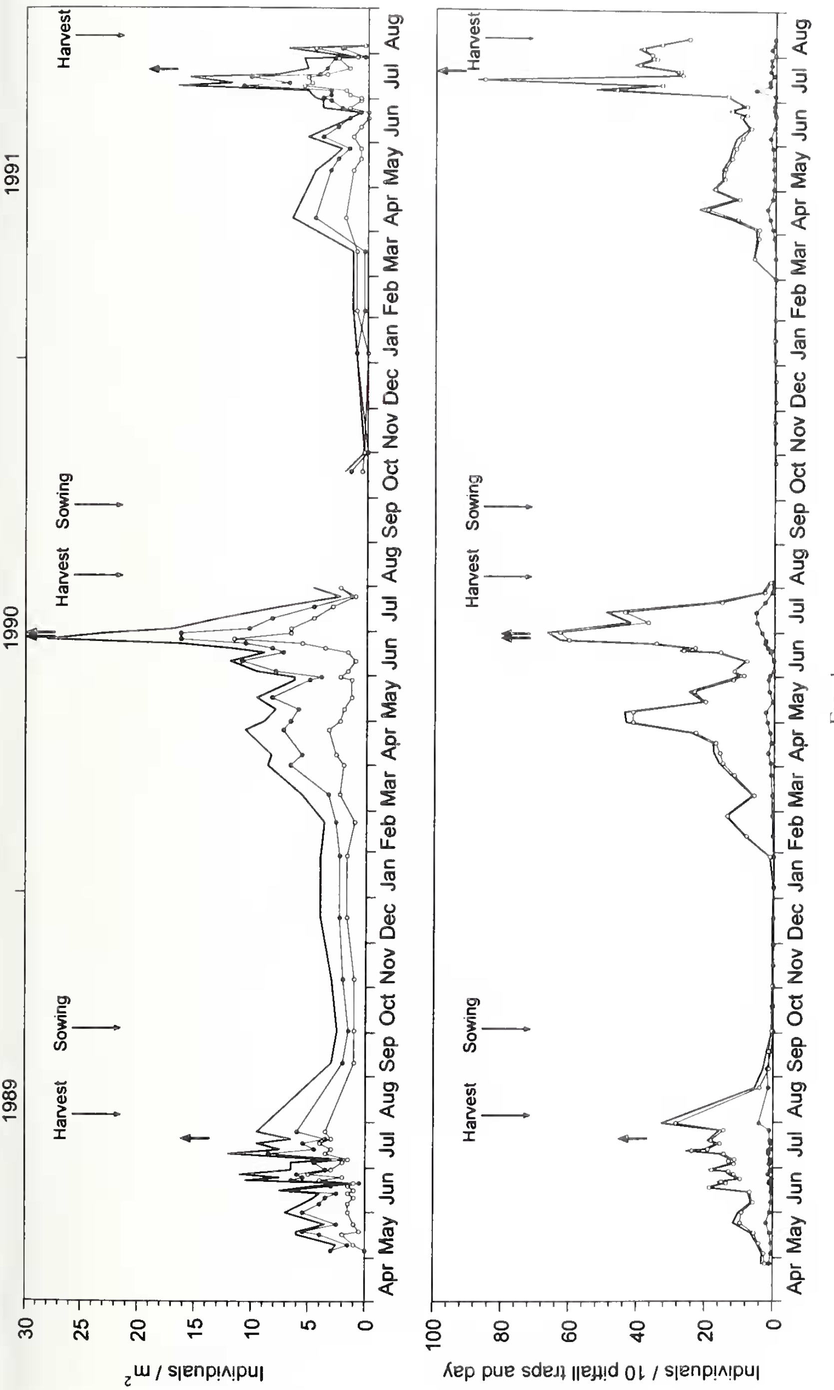

FIG. 1

Population dynamics of *E. atra* as determined by intensive D-vac sampling (individuals/m^2) and pitfall trap catches (individuals/10 pitfall traps and day) from April 1989 to August 1991 (thick line = total adults, white symbols = adult males, black symbols = adult females; thick, short arrows = observations of mass ballooning events).

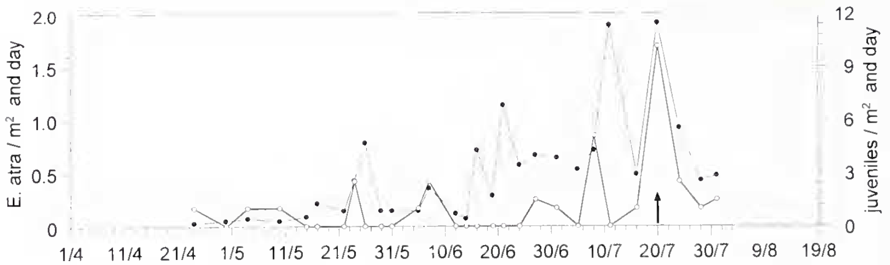

FIG. 2

Ballooning activities of *E. atra* adults (white symbols) and total juvenile spiders (black symbols) from April to August 1989 (arrow = observation of mass ballooning event).

TABLE 2

Densities of *Erigone* spp. eggsacs (number/m^2) as determined by intensive D-vac samples (3 m^2 each date) and percentage of eggsacs from which spiderlings emerged in 1990 and 1991.

1990			**1991**		
date	eggsacs/m^2	% of eggsacs from which spiderlings emerged	date	eggsacs/m^2	% of eggsacs from which spiderlings emerged
2.4.	1.3	75.0			
9.4.	2.0	83.3	10.4.	2.7	62.5
26.4.	1.0	100.0			
2.5.	3.0	88.9			
10.5.	1.7	60.0	13.5.	2.7	75.0
18.5.	7.0	52.4	21.5.	3.0	22.2
30.5.	3.3	10.0	28.5.	2.0	33.3
1.6.	4.3	38.5			
5.6.	5.7	17.6	5.6.	1.3	75.0
12.6.	4.7	14.3	12.6.	3.7	27.3
18.6.	3.3	50.0	18.6.	2.3	28.6
21.6.	5.7	41.2	22.6.	0.7	0
24.6.	8.3	48.0	25.6.	2.7	37.5
27.6.	6.3	26.3	30.6.	1.7	40.0
1.7.	3.7	45.5	2.7.	6.7	25.0
4.7.	6.7	45.0	4.7.	1.7	60.0
			7.7.	11.0	36.4
11.7.	23.3	10.0	10.7.	8.3	36.0
			12.7.	5.3	25.0
			16.7.	10.0	10.0
19.7.	12.0	13.9	18.7.	2.0	0
			22.7.	8.7	38.5
26.7.	23.0	4.3	29.7.	12.3	8.1
			30.7.	3.3	0
1.8.	10.7	0	5.8.	13.7	0
			7.8.	3.0	0

TABLE 3

Breeding of *E. atra* females (n = 20) during 10 days without food and observed date of hatch of spiderlings from these eggsacs under ambient temperatures in the field, and expected date of adult moult of these spiderlings*.

sampling date of females	females producing eggsacs (%)	eggsacs/female	observed date of hatch of spiderlings from these eggsacs	expected date of adult moult*
01.04.90	75.0	0.75	13. May	29. June
09.04.90	75.0	0.75	15. May	1. July
20.04.90	70.0	0.75	19. May	5. July
07.05.90	90.0	1.30	8. June	25. July
22.05.90	90.0	0.95	20. June	6. August
28.06.90	85.0	1.25	15. June	1. August
23.05.91	90.0	1.00	24. June	10. August

* according to DE KEER & MAELFAIT (1988): duration of juvenile development at 15 °C (comparable to mean ambient temperature of the study area): 47 days.

TABLE 4

Monthly mean parasitism rates (%) of *Erigone* spp. eggsacs in winter wheat in 1990 and 1991 (number of eggsacs in parentheses).

	April	May	June	July	August
1990	2.6 (38)	2.8 (109)	3.9 (285)	5.7 (580)	3.4 (88)
1991	5.3 (19)	0 (49)	1.6 (127)	5.6 (538)	1.8 (111)

Erigone spp. eggsacs found in the D-vac samples usually were fixed on small soil clods or plant material and first were found early in April. The number of eggsacs varied from 1.0 to 2.7 per m^2 in April and increased in May and June to 8.3 eggsacs/m^2 (Table 2). Densities of *Erigone* eggsacs increased at the same time as the density of adults (see Fig. 1). In April and May high percentage emergence rates of spiderlings from eggsacs were recorded. During the summer emergence rates declined.

In April and May always more than 75 % of *E. atra* females tested for breeding produced one or two eggsacs within a period of 10 days without food in the field. The minimum period until the emergence of spiderlings from eggsacs lasted between 18 to 42 days (Table 3). Taking into account laboratory results of DE KEER & MAELFAIT (1988) for duration of the juvenile development of *E. atra* at 15 °C, the moult of spiderlings to adults that emerged from eggsacs laid early in April 1990 would be expected by late June or early July.

The mean parasitism rates of *Erigone* spp. eggsacs were calculated using all available data, also including eggsacs sampled on four insecticide sprayed plots each

TABLE 5

Species composition of parasitoids emerging from eggsacs of *Erigone* spp. collected by intensive D-vac sampling in winter wheat from April to August in 1990 and 1991 (% = percentage of total parasitoids).

family/species	1990			1991		
	males	females	(%)	males	females	(%)
Ichneumonidae, total	22	32	90.0	7	32	97.5
Aclastus minutus (Bridgman)	16 + 1[1]	13	50.0	3	4	17.5
Aclastus sp.	1	-	1.7	-	-	-
Gelis declivis (Först.)	-	14	23.3	-	21	52.5
Gelis festinans (F.)	3	4	11.7	3	5	20.0
Gelis bicolor (Vill.)	-	1[1]	1.7	-	1 + 1[1]	5.0
Gelis hortensis (Christ)	1	-	1.7	-	-	-
Gelis viduus (Först.)	-	-	-	1	-	2.5
Pteromalidae, total	1	5	10.0	-	-	-
Spaniopus dissimilis Wlk.	1	5	10.0	-	-	-
Braconidae, total	-	-	-	-	1	2.5
Centistes cuspidatus Haliday	-	-	-	-	1	2.5
Total	23	37	100	7	33	100

[1]Identification doubtful.

TABLE 6

Longevity of female eggsac parasitoids of *Erigone* spp., ovipositor attack of parasitoids to one- to four-day-old *E. atra* eggsacs and juvenile development of parasitoids at 20 °C.

species	longevity (days)	n	ovipositor attack	juvenile development (days ± SD)	
				males	females
A. minutus	32 - 34	2	observed	18.9 ± 1.9 (n = 7)	22 (n = 1)
G. bicolor	37	1	observed	24 (n = 1)	-
G. declivis	32 - 59	2	observed	-	-
G. festinans	11 - 36	2	not observed	-	-

year. Parasitism of eggsacs occurred from April to August and was highest in July (5.7 % resp. 5.6 %) (Table 4). All parasitoids (n = 100) belonged to the Hymenoptera and were solitary. Besides species of the dominant family Ichneumonidae (2 species of *Aclastus* and 5 species of *Gelis*) two further parasitoid species of the families Pteromalidae and Braconidae were reared (Table 5). In 1990 50 % of the eggsac parasitoids were individuals of *Aclastus minutus* (Bridgman) while in 1991 the species *Gelis declivis* (Först.) occurred the most (52.5 %). The longevity of female parasitoids varied from 11 to 59 days (Table 6). Females of *A. minutus*, *Gelis bicolor* (Vill.) and *G. declivis* could be observed to oviposit into one- to four-day-old *E. atra* eggsacs within a period of 10 min after being released into glass tubes containing eggsacs. Juvenile development of male *A. minutus* was completed in 18.9 ± 1.9 days but a female needed 22 days. A male of *G. bicolor* was reared in 24 days after parasitism of an eggsac by a female.

DISCUSSION

E. atra can be regularly found in high abundance in European cereal fields (Hänggi *et al.* 1995). Intensive D-vac sampling and pitfall trapping recorded *E. atra* as the most numerous spiders species. In contrast *O. apicatus* adults were caught in high numbers only by pitfall trapping but not by intensive D-vac sampling. The active searching, non-webbuilding behaviour of *O. apicatus* adults (Thornhill 1983) and the higher trappability of *O. apicatus* adults in pitfall traps compared to *E. atra* adults seems to be responsible for this difference (Dinter, submitted). Schaefer (1976) classifies *E. atra* as a spider species which has the potential to have more than one generation per year. Based on the field data of this study the life cycle of *E. atra* in winter wheat can be characterized as follows:

After the overwintering of adults and probably also juveniles, activity of males (searching for unmated females) increases already in February/March. The increase in density of adults in March and April may be a combination of immigration, as ballooning activities of *E. atra* occur throughout the year (Sunderland 1990), and of overwintering spiderlings that moult to adults. The increasing numbers of young males and unmated females should stimultate the search of males for females and favour increasing pitfall trap catches of males in April/May. In April, females start to lay eggsacs. In the laboratory females of *E. atra* can produce at least 5 fertilised eggsacs (De Keer & Maelfait 1988*b*, Dinter & Poehling 1995). These eggsacs, together with the production of further eggsacs by newly hatched females result in a massive build-up of spiderling populations in May and June. Mortality due to old age may be the cause for the reduction of adult densities in late May and early June. Increasing food supply of Collembola, aphids and other phytophagous and zoophagous insects in the wheat crop and rising temperatures during May and June accelerate the growth and development of the spiderlings. These factors probably also tend to synchronise the developmental stages of spiderlings that hatched on different dates. Together these conditions seem to cause the quite rapid increase in the density of adults of a new generation of *E. atra* from late June to mid-July.

Natural decline in prey abundance and changing microclimate as a consequence of the ripening of the wheat may favour mass emigration (by ballooning) of newly matured *E. atra* adults and also, to some extent, the subadults. Weyman *et al.* (1994) showed in laboratory experiments that starved *E. atra* and *Erigone dentipalpis* (Wider) exhibited an increased tendency for aeronautic dispersal behaviour compared to satiated spiders. Legel & Van Wingerden (1980) report comparable results with *E. arctica*. An increasing population of eggsac parasitoids may also reduce the probability of successful spider reproduction and contribute to this trend (see below). Nevertheless it may be advantageous for a female to lay an eggsac in her birthplace (see increase in eggsac density in July/August) as ballooning bears the risks of mortality or inability to find a suitable new habitat for egg laying. The emigration of most *E. atra* adults before harvest seems to be advantageous under natural selection aspects as usually cereals will be ploughed after harvest, and ploughing can have severe negative effects on spider populations (DUFFEY 1978, EVERTS 1990). Field data from English winter wheat fields also show that ballooning activity synchronised with pre-harvest decline of total spider density in some years and not in others (SUNDERLAND & TOPPING 1993, K.D. Sunderland pers. comm.). Although there is still enough time for the development of a second generation of *E. atra* before autumn/winter there are no indications of a second mass reproduction as in June/July. Farming practices such as soil cultivation and ploughing, as well as unsuitable microclimate conditions and low food supply, may impair the build-up of a high second juvenile population. In heavily grazed pasture DE KEER & MAELFAIT (1988*a*) observed two generations of *E. atra*. The first generation became adult in June/July (which parallels findings in this study) and the descendants reached maturity in the pasture from September onwards.

After sowing of winter wheat in September densities of *E. atra* adults remained fairly stable during autumn and winter. Although high ballooning activities of *E. atra* adults often occur in autumn (SUNDERLAND 1990), the habitat quality of the investigated fields was obviously not favourable to cause an increasing number of *E. atra* adults to stay. The higher numbers of adults overwintering in 1989/90 compared to 1990/91 may be a result of the different location of the fields or differences in habitat quality. In a field experiment WEYMAN & JEPSON (1994) found that colonisation of barley by aerially dispersing spiders was higher where aphid prey was present compared to uninfested barley. However, further investigation of the factors underlying the establishment of high *E. atra* populations, in autumn in relation to the reduction of aphid propagation and transmission of barley yellow dwarf virus, would seem to be justified. Enhancement of the structural diversity (ALDERWEIRELDT 1994*b*) or improvement of natural food resources (Collembola) could be promising aspects to investigate.

Our knowledge of spider eggsacs parasitoids and their impact on the population dynamics of spiders is still quite incomplete. The present study illustrates that a complex of several Hymenoptera species parasitize *Erigone* eggsacs. VAN BAARLEN *et al.* (1994) found only 2 species of eggsacs parasitoids of *Erigone* spp. in cereals in England, *Gelis festinans* being the dominant species emerging from eggsacs. VAN WINGERDEN (1973) described that approximately 50 % of the eggsacs produced by the second generation of *Erigone arctica* were parasitized by two hymenopteran species (*Aclastus minutus*, *Gelis pumilus* (Foerster)) on a Dutch costal plain. The first species is also known to be a common parasitoid of *Lepthorhoptrum robustum* (Westring) eggsacs and has a polyvoltine life cycle (HORSTMANN 1970). *Aclastus* and *Gelis* species are potentially efficient antagonists of *Erigone atra* populations because they have a rapid juvenile development compared to that of *E. atra*, a longevity of up to two months and are efficient at finding hosts. Other linyphiids and species of other spider families are also attacked by these two hymenopteran genera (FITTON *et al.* 1987). *Centistes cuspidatus* Haliday seems to be a quite polyphagous species because it also parasitizes adult *Tachyporus* staphylinid beetles (RICHARDSON 1982). The low parasitism rates of *Erigone* eggsacs (< 6 %) found here in comparison to mean parasitism values of 17.1 % found by VAN BAARLEN *et al.* (1994) may be caused by methodological differences. An underestimation of eggsac parasitism rate due to damage of hymenopteran larvae in the eggsacs as a consequence of D-vac sampling may be possible, especially in July and August when the soil was quite dry.

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